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ABSTRACT

The California Mathematics Project (CMP) was created in 1982 to improve mathematics competence of students by implementing exemplary in-service training programs for existing mathematics teachers. This report provides a summary of local project evaluations and an assessment of the extent of program implementation and progress toward achieving project goals. In addition, the report seeks to establish the basis for evaluating project effectiveness in 1987 by clarifying the role of in-service teacher training in the improvement of students' mathematics competence and its relationship to issues of program evaluation. The report includes comments on: the decline in and efforts to improve students' mathematics competence; enactment of the CMP; implementation of the project; the nine local California projects; goals and objectives of the projects; progress to date on local project activities; and local project evaluations. A summary and conclusions are also included. It is pointed out that the project has made reasonable progress in implementing its mandated goals and objectives and that successful achievement of the goals is likely to hinge on issues related to the geographic distribution of mathematics skills training; attention to the needs of females, minority, and low-income students; and project evaluation. (Individual project summaries are provided in an appendix.) (JN)

REPORT ON THE CALIFORNIA MATHEMATICS PROJECT

POSTSECONDARY EDUCATION COMMISSION

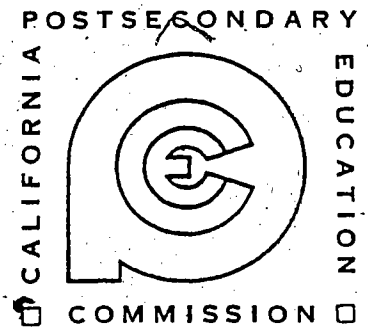
CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

The California Postsecondary Education Commission was created by the Legislature and the Governor in 1974 as the successor to the California Coordinating Council for Higher Education in order to coordinate and plan for education in California beyond high school. As a state agency, the Commission is responsible for assuring that the State's resources for postsecondary education are utilized effectively and efficiently; for promoting diversity, innovation, and responsiveness to the needs of students and society; and for advising the Legislature and the Governor on statewide educational policy and funding.

The Commission consists of 15 members. Nine represent the general public, with three each appointed by the Speaker of the Assembly, the Senate Rules Committee, and the Governor. The other six represent the major educational systems of the State.

The Commission holds regular public meetings throughout the year at which it takes action on staff studies and adopts positions on legislative proposals affecting postsecondary education. Further information about the Commission, its meetings, its staff, and its other publications may be obtained from the Commission offices at 1020 Twelfth Street, Sacramento, California 95814; telephone (916) 445-7933.

REPORT ON THE CALIFORNIA MATHEMATICS PROJECT



CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

1020 TWELFTH STREET, SACRAMENTO, CALIFORNIA 95814

Commission Report 84-7

Adopted January 30, 1984

Contents

Tables

Map

THE CALIFORNIA MATHEMATICS PROJECT

IN 1982, the Legislature created the California Mathematics Project (Chapter 196 of the Statutes of 1982), the purpose of which is to improve mathematics competence of students through implementation of exemplary in-service training programs for existing teachers of mathematics. Section 5 of this statute requires the California Postsecondary Education Commission to provide the Legislature with two reports on the project: the first by January 1, 1984 and the second by January 1, 1987. This report represents compliance with the first responsibility by providing a summary of local project evaluations and an assessment of the extent of program implementation and progress toward achieving project goals.

In addition, the report seeks to establish the basis for evaluating project effectiveness in 1987 by clarifying the role of in-service teacher training in the improvement of students' mathematics competence and its relationship to issues of program evaluation.

THE DECLINE IN STUDENTS' MATHEMATICS COMPETENCE

Few current topics in education have received greater attention in the State and in the nation than has improving the mathematics proficiency of students. The problem of students' mathematics competence is not a recent phenomenon, but one with a relatively long and complex history. Students' mathematics competence, as measured by standardized tests, began to decline in the early 1960s. The SAT Math scores for high school seniors declined steadily from 1962 to 1978 and, after a slight improvement in 1979, they have remained relatively stable at a level nearly 40 points lower than that of 20 years ago. Mathematics achievement levels in the lower grades -- third, sixth, and ninth -- have shown some improvement over the last decade, however, and twelfth-grade average scores increased for the first time in 1982.

Many students entering America's public four-year colleges are ill-prepared to complete successfully the first year of college mathematics. Between 1975 and 1980, remedial mathematics courses in public four-year colleges nationally increased by 72 percent and now constitute one-quarter of all mathematics courses taught in these institutions. In California, these courses constitute about 5 percent of the mathematics courses offered in the public four-year colleges and universities, but nearly 10 percent of the mathematics enrollments. In California's Community Colleges, these remedial mathematics courses constitute nearly one-third of all mathematics courses and over 50 percent of the mathematics enrollment. Over $20 million was spent on remedial mathematics courses in these three segments in 1980-81.

Many factors have contributed to the decline of mathematics competence of students -- including unfocused secondary school curricula, low or unarticulated standards and expectations of competence, poor textbooks, inadequate instructional materials, and several issues related to teachers.

- Secondary school curricula have become homogenized, diluted, and diffuse. With extensive student choice, a large majority of recent high school graduates have not availed themselves of the intermediate and advanced courses in mathematics. Few students take mathematics beyond tenth grade.
- A decline in the level of expectations or standards of competence is also apparent. The amount of homework required has decreased in all subject areas and is an important concern in mathematics because mastery of both computation and problems-solving skills require practice. Average grades are higher despite declining average student achievement which generates a contradictory message regarding competence.
- High school diploma requirements are also a statement of expectations for academic competence. In a 1980 state-by-state survey of high school diploma requirements, 35 states required only one year of mathematics. In California, high school graduation requirements have been set by local school districts and one year of mathematics is the median mathematics requirement.
- College admission standards also serve to give notice of competence expectations for those students interested in continuing their edu-

cation. Most college admission standards in the United States stress grades, without adequate attention to the nature and level of courses completed. Until this year, admission to the University of California required two years of mathematics in the four years of high school. Many University-bound students completed these requirements in their first two years and chose less academic courses during the rest of their time in high school. The California State University admission requirements are a straight combination of high school grades, excluding physical education, military science and work experience, and test scores.

- During the past decade, textbooks have been "written down" to an ever-lower reading level in response to perceived market demands. Many books do not challenge the students to whom they are assigned. Moreover, expenditures for texts and other instructional materials have declined 50 percent over the past 17 years. While recommended budget levels for these areas are 5 to 10 percent of the operating cost of schools, these budgets represent only 0.7 percent today.

- An inadequate supply of well-qualified mathematics teachers has also contributed to the decline in mathematics competence among students. Many factors have contributed to this condition -- among them, low average salaries coupled with well-paying alternative employment opportunities in an economy increasingly dependent on technical and quantitatively competent employees, weaknesses in the teacher preparation curriculum which emphasizes coursework in "educational methods and theory" at the expense of subject area courses, and the below-average academic skills of entering teacher education students, many of whom nationally come from the bottom quarter of high school graduates going on to college.

- Finally, the lack of well-qualified teachers has been compounded by fiscal constraints and declining numbers of elementary and secondary students. As the number of students and financial resources declined and well-qualified mathematics teachers left teaching for more remunerative careers, schools were unable to hire new well-qualified teachers and shifted underutilized teachers from other disciplines such as physical education, social science and English to teach mathematics -- a subject they were not adequately trained or qualified to teach. In California, the shortage of well-qualified mathematics teachers in most districts has been resolved by transferring such other teachers into these courses.
- In a few areas, most notably the Los Angeles Unified School District, new teachers are being recruited but with only limited success. This year, Los Angeles reported a need for more than 600 mathematics teachers, but California's two public university systems are reportedly preparing fewer than 100 mathematics teachers annually. While teacher preparation programs in independent colleges and universities may supply as many as 40 more a year, demand from just this one district exceeds the supply generated by all the colleges and universities in the State.

EFFORTS TO IMPROVE STUDENTS' MATHEMATICS COMPETENCE

Serious efforts on many fronts are now seeking to upgrade students' mathematics competence. The inadequacies of curriculum, academic standards, textbooks, instructional equipment, and teacher skills described above are all being examined and reforms implemented.

[redacted] the curriculum, the Association for [redacted]vision and Curriculum Development has [redacted]ized a national network of high schools to redefine a complete curriculum for all their students. In California, the State Department of Education has developed a "Handbook for Planning an Effective Mathematics Program" and will be developing a new statewide mathematics framework during 1983-84.

Regarding standards and expectations, earlier this year the National Commission on Excellence in Education recommended model state and local high school graduation requirements which would include three years of mathematics for all students, thereby requiring substantial revision of mathematics curriculum for vocationally oriented students. More specifically, it stated (p. 25):

> The teaching of mathematics should equip graduates to: (a) understand geometric and algebraic concepts; (b) understand elementary probability and statistics; (c) apply mathematics in everyday situations; and (d) estimate, approximate, measure, and test the accuracy of their calculations.

California's educational institutions have already begun to change and upgrade their state-

ments of mathematics competence. The State Board of Education approved model graduation requirements this past June that recommended three years of mathematics in high school. The University of California has implemented new admission requirements for 1984, raising the academic units required to 16, including three years of mathematics, and specifying that a certain minimum of these units must be completed in the last two years of high school. In 1986, the University will also grant supplemental grade-point enrichments for honors courses taken in high school. In 1985, the California State University will require a minimum of two years of mathematics for admission.

In addition to publishing the requirements, California's Round Table on Educational Opportunity has increased its efforts to inform high school students, teachers, and counselors about them. They have prepared a booklet for eighth grade students, *Futures*, that discusses students' high school choices and their implications for college and work. Moreover, the Joint Academic Senates of the University, the State University, and the Community colleges have published a "Statement on Preparation in English and Mathematics: Competencies Expected of Entering Freshmen" for teachers and parents.

Regarding textbooks, both the State Department of Education and local school districts have placed ever-increasing emphasis on the improvement of these books and other instructional materials. During the State's 1983-84 budget cycle, major legislation reforming and financing the public schools was enacted, an important component of which was improvement in the funding level for instructional supplies for both elementary and secondary schools.

In the area of teacher supply and quality, many efforts are underway simultaneously. Basic skills competency examinations are being required of teachers applying for new credentials. Schools of education are reviewing and upgrading their teacher preparation curricula and reexamining and increasing their admission requirements and competence expectations as needed. The recently passed legislation includes provisions for raising of beginning salaries for teachers, although implementation of this provision will depend on future budget allocations.

In addition, the Legislature has recognized the critical nature of the issue of teacher competence for the improvement of student competence. Immediate and concrete efforts are needed to begin to upgrade existing teachers' skills and expand opportunities for their retraining. The State's regional Teacher Education and Computer Centers have been providing in-service training opportunities for teachers in all disciplines from kindergarten through the twelfth grade, but the Legislature has funded another set of resources besides these centers in the specific area of mathematics because of the particularly serious in-service training needs in this field. The California Mathematics Project endeavors to attack the problems of student mathematics competence from this perspective.

ENACTMENT OF THE CALIFORNIA MATHEMATICS PROJECT

The Legislature created the California Mathematics Project to develop and fund exemplary in-service projects for mathematics teacher training and thereby help existing teachers gain skills to increase mathematics proficiency among their students. (A copy of the legislation is reproduced in Appendix A on pages 11-16.)

The legislation stresses the use of cooperative, intersegmental approaches to solving the problems of mathematics competence which involve various levels and segments of education, integrate existing resources for in-service teacher training, and demonstrate shared financial and personnel support. The legislation stipulates that the project is to be jointly administered by the University of California and the California State University with advice from a broadly constituted advisory committee representing every level and segment of California education, business and industry, and labor.

While recognizing that a variety of possible models for such in-service programs exist, the legislation emphasizes several objectives:

1. Attention to the special problems of female, minority, and low-income students to develop skills and attitudes which will enable them to pursue mathematics successfully in later grades,
2. Development of problem-solving skills which are necessary to advance to college mathematics or to jobs in technical fields,
3. Clarification of the standards of mathematics competence required at each school level and the development of instructional strategies and curricula to meet these standards,

4. Distribution of projects throughout the State so that elementary, secondary and postsecondary school personnel located in rural, urban, and suburban areas may avail themselves of mathematics skills training.

The legislation also recognizes the importance of evaluation by each project to on-going self-assessment and project improvement. As mandated by the Legislature, the Commission's evaluation in 1987 of project effectiveness and its recommendations for future legislative action will assess these self-evaluation efforts and related project improvements.

Funding for the project was not included in the enabling legislation, but a related bill, AB 3266, which created the Council on Technology Education, included approximately $1.2 million for the State Department of Education from the Governor's "Investment in People" initiative to fund exemplary projects. After AB 3266 became law, the Council on Technology Education recommended, and the State Board of Education approved, the transfer of half of these funds to the University of California to fund exemplary projects in mathematics teacher training as approved by the California Mathematics Project. The State Department of Education transferred approximately $630,000 to the University this past June to undertake the project.

IMPLEMENTATION OF THE PROJECT

Although the University did not receive funding for the project until last June, project implementation began in the fall of 1982. The first task was the establishment of the Project Advisory Committee. (A list of the members of this Committee and the organizations they represent appears in Appendix B on page 17.)

In November 1982, the Advisory Committee approved a request for proposals (RFP) for projects that would provide staff development for teachers of the full range of mathematics subjects from kindergarten through the Community Colleges. The Committee used nine criteria explicit in the RFP to evaluate project proposals for funding while also endeavoring to ensure reasonable geographic and grade-level distribution of these training opportunities. Table 1 on the opposite page compares these criteria with the major objectives stipulated in statute.

All Advisory Committee members reviewed 17 project proposals and completed an evaluation worksheet for each of them. This last February, the Committee recommended funding for eight projects, provided the project directors complied with certain requests to clarify or modify their proposals. The Committee asked three other project directors to revise their proposals, and approved one of them in March. (Detailed descriptions of each of the nine projects appear in Appendix C on pages 19-38.)

THE NINE LOCAL CALIFORNIA MATHEMATICS PROJECTS

Achievement of the goals and objectives of the overall California Mathematics Project depends on their effective implementation through its local projects. While the primary goal of every local project is the improvement of mathematics education in California by providing services to existing mathematics educators, the structure, content, techniques, and procedures of the projects are quite diverse. Of the nine projects funded thus far by the California Mathematics Project, eight provide direct services to existing teachers through staff development efforts designed to improve their teaching effectiveness. The ninth is a research-based project designed to assess the in-service needs of mathematics teachers in San Diego and Imperial Counties and evaluate the effectiveness of the other San Diego area project. Table 2 on page 6 lists the nine projects, their consortia participants, level of funding, number of participating teachers, and grade levels served.

The map on page 7 illustrates the counties in California from which teachers have participated in the training programs offered by these local projects.

The remaining sections of this overview summarize the local projects' goals and objectives in light of those established by the Advisory Committee, describe the nature of local project activities and the extent to which they have been implemented, and review the nature of evaluation activities proposed and implemented by the projects.

GOALS AND OBJECTIVES OF THE LOCAL PROJECTS

Despite the similarity of their primary goal, the specific objectives established by the local projects and the activities they have implemented to

TABLE 1 Legislative Requirements and Advisory Committee Criteria for Local California Mathematics Projects

Legislative Requirements	Advisory Committee Criteria
Cooperative, intersegmental in-service training models to solve problems related to mathematics competence of students.	1. Provisions for intersegmental consortia. 2. Evidence of commitment from districts, institutions, agencies, etc. 3. Emphasis on staff development through the development of techniques for existing teachers of mathematics to improve their effectiveness and that of their colleagues, or development of strategies to enable teachers in fields other than mathematics to become effective teachers of mathematics, or other staff development efforts to improve mathematics education.
Attention to special problems of female, minority, and low-income students.	4. Provision for response to special mathematics needs of females, minorities, and low-income students. 5. Provision for particular needs of prospective participants. 6. Relationship between needs assessment and proposed project.
Attention to the development of problem-solving skills.	(Not a specified criterion.)
Clarification of standards of mathematics competence at all levels.	7. Clarification of standards of mathematics competence.
On-going self-assessment and evaluation for project improvement.	8. Provision for valid evaluation of the project.
Geographic and grade level distribution of training opportunities.	(Not a criterion for individual projects but for overall distribution of funds.) 9. Provision for effective dissemination of project results.

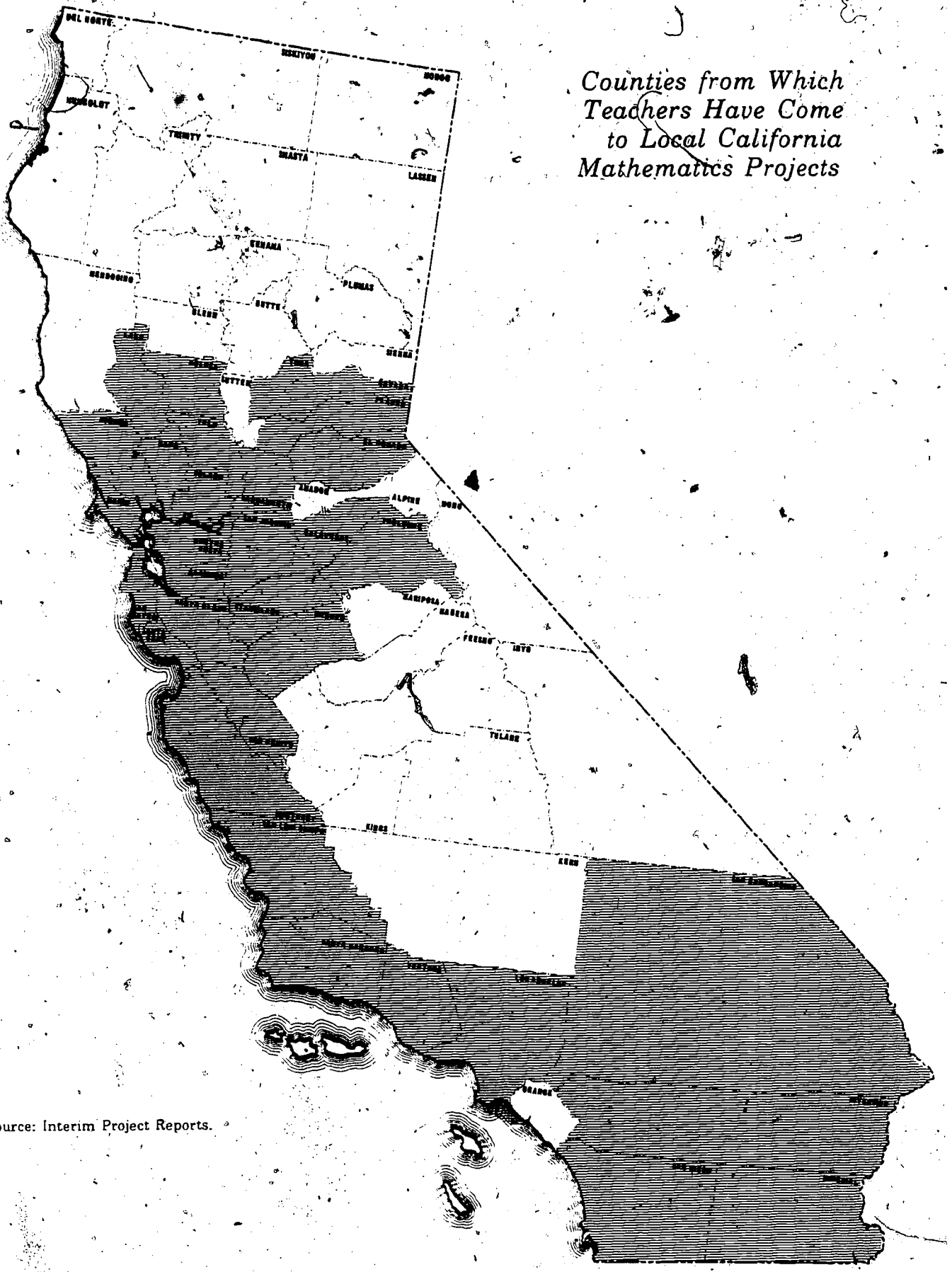
Sources: Legislative Requirements, Chapter 196, Statutes of 1982; Advisory Committee Requirements, Advisory Committee Request for Proposals.

TABLE 2 Local California Mathematics Projects, Their Consortium Members, Funding Levels, and Participants Served, 1983

Project Title	Consortium Members	Project Funding	Participants	
			Number Served	Grade Levels
Bay Area Mathematics Project	UC Berkeley: Lawrence Hall of Science: California Mathematics Council: Bay Area Advisory Committee; Regions 3, 6, and 8 TECC*	$116,576	150	K-14
Central California Mathematics Project	California State College, Stanislaus: Region 7 TECC	$18,300	22	7-12
Improvement of Mathematics Through Problem Solving	California State College, San Bernardino; Region 13 TECC, San Bernardino and Riverside County Offices of Education	$75,000	60	4-12
Mathematics Instruction Through the Use of Computers	San Jose State University; Region 8 TECC	$38,652	25	K-12
Northern California Mathematics Project	UC Davis; California State University, Sacramento; Region 8 TECC	$83,416	30	4-12
San Diego State University Mathematics Project	San Diego State University; San Diego County Office of Education; UC San Diego	$63,462	47	9-12
Tri-County Mathematics Project	UC Santa Barbara; Tri-County Region 9 TECC	$61,664	25	7-12
UCLA/CSUN Mathematics Project	UCLA; California State University at Northridge	$106,461	47	K-14
UCSD Mathematics Project	UC San Diego; San Diego State University; San Diego and Imperial Counties Office of Education	$54,571	N/A	9-12
Project Administration	University of California; California State University	$11,759		

*TECC = Teacher Education and Computer Center

Source: Preliminary Reports, Local Projects.



Counties from Which Teachers Have Come to Local California Mathematics Projects

Source: Interim Project Reports.

achieve the overall Project's aims vary considerably. To illustrate the similarities and differences among local projects, the following section summarizes their objectives in light of the Advisory Committee's criteria within the Project's requirements as specified in statute.

Cooperative, Intersegmental In-Service Models

Each of the nine projects has established consortial relations among two or more segments of education, but the degree of involvement of the members of the consortia differs considerably among projects. This involvement has ranged from letters of support through use of teaching resources and materials to matching funds for participant support and providing release time for teachers to deliver or participate in in-service training during the school year. The ultimate test of cooperative projects of this type may rest with the degree to which agencies already involved in teacher retraining stay involved in the project and make it a permanent part of the techniques they use to resolve the problems hindering adequate mathematics competence of California's students.

Of the eight projects that have provided direct services to teachers, all have emphasized the concept of "master teachers" -- a cadre of well-qualified mathematics teachers who could provide leadership in the improvement of mathematics education. A central objective for six of these projects has been the training and development of these participating teachers as in-service mathematics trainers. A seventh project has planned to focus on this objective in subsequent activities, while the eighth project has relied more heavily on revitalizing these teachers in their own classroom with the expectation that this will have beneficial influence on other teachers in their schools. This eighth project has also been the only one to include as an objective the improvement of the mathematics skills of less well-prepared mathematics teachers. The objectives of the ninth project are related to how well the eighth project achieves its objectives in light of in-service training needs in their area.

Special Mathematics Needs of Female, Minority, and Low-Income Students

Four of the projects specifically identified as one of their objectives attention to the special needs of students who have traditionally been underrepresented in mathematics courses beyond the seventh grade. Three other projects included one or more activities aimed at issues in this area.

As part of their proposals, all projects at least began to examine the in-service needs of the teachers in their regions and the specific problems they encounter or will encounter in their effort to improve students' mathematics competence. Changing demographics of the State will make attention to this objective increasingly important in the future.

Development of Problem-Solving Skills

Interestingly, while the request for proposals issued by the Advisory Committee did not stipulate that projects had to focus on the development or enhancement of problem-solving skills, all projects included this subject area concentration to some degree. In some cases, problem solving was the topic of one of a number of courses taken by participants while in others it was the fulcrum for all project activities. Some projects approached it with traditional paper-and-pencil techniques while others emphasized the use of manipulatives, computers, or other less traditional methods.

Clarification of Standards of Mathematics Competence

Because all of these projects served better-prepared teachers, sought to stimulate their interest, recognize their competence, and expand their range of mastery, the standards of mathematics competence were under constant scrutiny. The sharing of information about standards or expectations of competence by project staff and among project participants broadened the discussion and concerns related to this issue. In many cases, participating teachers were provided with facts and strategies necessary to change their schools' curriculum to increase the likelihood of improving students' mathematics competence.

On-Going Evaluation for Project Improvement

Each project proposal included a description of the evaluation methodologies to be implemented for self-assessment and project improvement, and in interim reports that the project directors submitted in September, they reviewed their preliminary evaluation results. A subsequent

section of this report discusses these self-evaluation efforts in greater detail.

PROGRESS TO DATE ON LOCAL PROJECT ACTIVITIES

Seven of the projects conducted institutes this past summer for teachers. Despite the lateness of project funding, project directors were able to implement these summer institutes very nearly as planned. In their interim reports, all of the project directors indicated that, based on staff and participants' review, the objectives for this portion of the projects were well met and reasonable progress had been made in achieving other project objectives.

All of the projects are planning school-year follow-up activities, such as in-service workshops by participants, which for the most part are yet to be implemented. These project components are expected to shed further light on the adequacy of project implementation and progress toward project goals and objectives.

The eighth project scheduled all of its activities during the school year. By September, preliminary planning and participant selection had taken place, but no activities involving these participants had yet been implemented. While the timing of this project is different from the others, its emphasis on master teachers, improvement of problem-solving mastery, and in-service leadership development is similar to most of the rest.

The ninth project suffered most noticeably from the lateness of funding. In its original proposal, it was to make pre-project observations in area schools to construct a baseline for measuring possible changes engendered by the new in-service efforts supported by the California Mathematics Project. The lack of funding made it impossible to implement this set of activities. The projects' directors hope to compensate for this lack by some control-group observation during the coming school year. The project has developed and implemented evaluation methodologies for the summer institute of the other project funded in its area, and it also plans evaluation efforts for that project's academic-year activities.

LOCAL PROJECT EVALUATIONS

The evaluation plans of local projects are as varied as the projects themselves. Their degree of complexity appears to depend on the qualifications of the evaluator -- whether project staff or outsider -- and the timing with which the evaluation efforts were implemented. Specific evaluation methodologies include:

1. Administering questionnaires of attitudes, expectations, and satisfaction with the project to the participating teachers, in some cases both prior to and following the summer institute and, in at least one case, at the end of the project's first full year.
2. Staff evaluations of project implementation and participant involvement.
3. Participant self-evaluation of daily activities through questionnaires or individual narrative journals that are shared with the staff.
4. Pre- and post-testing of mathematical problem-solving and reasoning skills in at least one project.
5. Documenting the extent of in-service training efforts, demographic characteristics, performance, and/or satisfaction of teachers who attend the in-service workshops to be conducted by the project participants.

The interim project reports provided preliminary evaluation results and discussions of how evaluation information was used to modify both project activities in process and plans for project activities during the school year and in subsequent years.

SUMMARY AND CONCLUSIONS

The California Mathematics Project has made reasonable progress in implementing its mandated goals and objectives, especially in light of the lateness of its funding. Successful achievement of these goals and objectives is likely to hinge on further analysis and planning regarding three particular issues: (1) the geographic distribution of mathematics skills training; (2) attention to the special needs of female, minority, and low-income students; and (3) project evaluation.

Geographic Distribution of Training

The currently funded projects have provided mathematics-skills retraining to teachers at most grade levels in 33 counties in the State. Three major areas remain unserved, however: two major geographic areas -- northern California and the southern central valley -- and the other one a major population center -- Orange County. The nine local projects were selected on the basis of the quality of their program pro-

posals, and this criterion must remain intact; but the Advisory Committee may wish to encourage educational groups in these two unserved areas to work with existing project directors in developing model programs that could effectively serve the in-service training needs of mathematics teachers in these areas.

Attention to the Needs of Students

Several currently funded projects have planned to provide teachers with strategies for attending to the special needs of female, minority, and low-income students. The projects' interim reports provide little information, however, on how well this information was received by participants and how likely it was to change or improve mathematics competence among their students. Because this is an explicit major objective of the Project as enacted, the Advisory Committee should consider placing greater emphasis on it and encouraging projects to document more clearly what they have done in this area and what its impact on classroom teaching and student competence has been. An additional activity in this area that should be encouraged is the active recruitment of teachers in high-minority districts as participants in local project activities.

Project Evaluation

The issues related to evaluation are quite complex. As noted above, the quality of the evaluation efforts implemented by local projects has varied widely. Most projects have established procedures that review project activities quite well, but the impact of project activities on participants' level of skills and on teachers' classroom behavior and, subsequently, on students' performance has not been attended to equally well.

Admittedly, the assessment of impact on student competence poses many difficulties. Standardized tests, which have served in most recent literature as the measures of students' competence, do not currently include components that measure students' problem-solving skills -- the focus of all currently funded projects. Furthermore, as noted in the introductory section of this report, many activities in many different areas are underway in California that could, and hopefully will, result in an improvement in average mathematics achievement by students. Separating the effects of any one activity, such as the California Mathematics Project, from the effects of the others would be virtually impossible.

However, in the other two areas of evaluative concern, the Advisory Committee should take a leadership role in guiding projects to prepare a baseline evaluation methodology that will allow for accurate presentation of the projects' influence on the skills of their participants and the effectiveness of their teaching. Many projects include evaluation elements that could be applied effectively for all projects, while allowing individual projects to implement those evaluation strategies that examine project activities unique to them.

At its most recent meeting, the Advisory Committee and the project administrators began work on resolving some of these issues. Equally encouraging was the transfer of funding for the California Mathematics Project to the University of California in the 1983-84 Budget Act. This action should prevent unnecessary delays in funding future projects. In addition, cognizant of the need to distribute mathematics skills training opportunities throughout the State, the Committee has decided to establish open competition for all current-year funds, thus encouraging all interested educational groups to submit proposals. Finally, project administrators have agreed to provide direction for establishing a uniform evaluation method during the current year to be implemented by projects funded in 1983-84.

APPENDIX A

Chapter 196, Statutes of 1982

An act relating to the California Mathematics Project, making an appropriation therefor, and declaring the urgency thereof, to take effect immediately.

LEGISLATIVE COUNSEL'S DIGEST

SB 424, Carpenter. Postsecondary education: California Mathematics Project.

Existing law vests the authority to manage and control the University of California in the Regents of the University of California.

This bill would provide for the establishment of a California Mathematics Project by the regents. The project would be administered jointly by the California State University and Colleges and the University of California, and would seek to solve the mathematics skills problem of students in California by cooperatively planned and funded efforts. It would require that the resource center policy board of each resource center have the opportunity to review and comment on mathematics project applications, and that the California Postsecondary Education Commission provide specified information to the Legislature concerning this project.

This bill would be operative, and apply to the University of California and the California State University and Colleges, only for such times as the Legislature has appropriated funds therefor and the regents have accepted such funds.

This bill would reappropriate any general funds made available under a specific item in the general support appropriation for the University of California in the Budget Act of 1981 for support of the California Mathematics Project in the 1981–82 fiscal year.

This bill would specify that the level of program implementation in the 1981–82 fiscal year is to be determined by the amount reappropriated and, in subsequent fiscal years, by the amount appropriated in the annual Budget Act.

This bill would take effect immediately as an urgency statute.

Appropriation: yes.

The people of the State of California do enact as follows:

SECTION 1. The Legislature recognizes that our society is becoming increasingly technical and dependent upon mathematical skills, concepts, and thought processes. Many colleges, universities, and vocational-technical programs require mathematics courses for graduation and more and more occupations demand a background in mathematics. Citizens and consumers must frequently be able to draw inferences from quantitative information, to interpret it, and to be alert to misinterpretations.

Despite these trends, complex problems must be overcome if mathematics education is to advance students to a level of competence appropriate for an increasingly technological society. The decline in mathematical skills of students in schools, colleges and universities in California affects all students, but is particularly acute for women students, minority students, and students from lower-income groups. The problems related to this situation include, but are not limited to:

(a) Inadequate mastery by students of the mathematics techniques taught in high school, resulting in poor comprehension of college course-work and high attrition rates for those students who have these deficiencies.

(b) A tendency among young women to avoid taking advanced mathematics courses in high school, which limits their choice of educational options, and screens them out of future careers in science, engineering, and other mathematically related professions.

(c) Lack of mathematics instruction at the elementary school level to enable all students, including female, minority, and low-income students to develop skills and attitudes which will enable them to pursue mathematics successfully in later grades.

(d) Concentration on minimum computational abilities, at all levels of schooling, with the result that opportunities for students to develop problem-solving skills necessary to advance to college mathematics or to jobs in technical fields may not be available.

While some colleges and universities are improving courses in the teaching of mathematics, this will not fully address the problem, since the number of new teachers to be hired in the future will be relatively small. Therefore, the Legislature recognizes the need to assist

existing teachers in gaining skills necessary to increase mathematics proficiency among students. The Legislature further recognizes that the mathematics problem is shared by all segments and levels of California education, and that it can best be addressed by cooperatively planned and funded efforts.

The Legislature finds that appropriate models for a cooperative, intersegmental approach to solving the mathematical skills problem should address the findings of state and national mathematical associations such as the National Council of Teachers of Mathematics and its affiliate, the California Mathematics Council. The comprehensive approach shall give special attention to providing in-service training of classroom teachers, defining more clearly those standards of mathematical competence required at each school level, and developing curricula and instructional strategies to meet these standards. Whenever possible, existing resources shall be pooled to support this comprehensive program. Models for the program could include the California Writing Project, EQUALS project, and the MESA project.

SEC. 2. With funds appropriated therefor [illegible] Regents of the University of California shall establish a cooperative endeavor entitled the California [illegible]hematics Project to be administered jointly by the California State University and Colleges and the University of California. Mathematics projects shall be distributed throughout the state so that elementary, secondary, and postsecondary school personnel located in rural, urban, and suburban areas may avail themselves of mathematics skills training.

The California Mathematics Project shall establish an advisory committee to assist in selecting proposals to be funded and establishing criteria for project evaluation. The advisory committee shall evaluate the progress of the California Mathematics Project, including an assessment of objective and operations, and recommend appropriate changes. It is the intent of the Legislature that the composition of the advisory committee shall be as follows:

(a) One representative selected by the California Postsecondary Education Commission.

(b) Two representatives selected by the President of the University of California, one of whom has responsibility for teaching mathematics.

(c) One member of the mathematics faculty and one representative selected by the Chancellor of the California State University and Colleges.

(d) One teacher of mathematics and one representative selected by the Chancellor of the California Community Colleges.

(e) One teacher of mathematics and one representative selected by the Superintendent of Public Instruction.

(f) One teacher of mathematics and one representative of an independent postsecondary institution selected by the Association of Independent California Colleges and Universities.

(g) One representative of business and industry, selected by the Industry Education Council of California.

(h) One representative of California labor, selected by the American Federation of Labor-Congress of Industrial Organizations (AFL-CIO).

SEC. 3. The California Mathematics Project shall establish criteria for approval of mathematics projects. These criteria shall include, but not be limited to, the extent to which:

(a) The objectives of the mathematics projects proposed include the following objectives:

(1) The mathematics project proposed addresses the need to clarify standards of mathematical competence at each school level.

(2) The mathematics project proposed addresses the need for women and minorities to continue with those mathematics courses required to enhance future career options.

(b) The strategies incorporated in the mathematics projects proposed include the following strategies:

(1) The mathematics project proposed is designed to improve systematically the mathematics skills of project participants, the teachers to be trained by participants, and ultimately, students attending public elementary, secondary, and postsecondary schools.

(2) Participating districts, colleges, and universities intend to integrate the mathematics project with any staff development programs provided by regional resource centers established in the same geographic area pursuant to Chapter 3.1 (commencing with Section 44670) of Part 25 of the Education Code.

(3) Participating districts, colleges, and universities intend to provide financial and personnel support for the mathematics project.

(4) Participating school districts select project participants so that a person or persons from a secondary school attends the project with a person or persons from that school's feeder elementary school or schools.

(5) The project involves various levels and segments of education in a cooperative approach.

(6) The project uses participants as mathematics skills trainers in school districts, colleges, and universities.

(7) The project provides continuing mathematics skills training to project participants.

(c) Proposals which meet the above criteria shall be submitted to the advisory committee for review and recommendation. Funding shall be provided to projects, which as a group, provide a comprehensive approach to solving the problems identified in Section 1 of this act.

SEC. 4. The resource center policy board of each resource center established pursuant to Article 2 (commencing with Section 44680) of Chapter 3.1 of Part 25 of the Education Code shall have the opportunity to review and comment on any application submitted by a mathematics project applicant located within the geographic region of such center.

SEC. 5. The Legislature recognizes some measurement devices are available to provide an evaluation of limited scope of the California Mathematics Project, including, but not limited to, teacher attitude surveys and pretesting and posttesting of the mathematics skills of those students reached by the program. Such evaluation can serve as a useful tool for ongoing self-assessment and improvement of local mathematics projects.

Therefore, each local mathematics project shall conduct an ongoing evaluation intended to provide some measure of the mathematics skills of students reached by the site program, project site participants' attitudes toward the effectiveness of the local mathematics project, and other information the advisory committee and site directors deem appropriate.

The California Postsecondary Education Commission shall provide the following information to the Legislature:

(a) By January 1, 1984, a summary of the local project evaluations and an assessment of the extent of program implementation and progress toward achieving project goals.

(b) By January 1, 1987, an evaluation of project effectiveness and recommendations for legislative action regarding the California Mathematics Project.

SEC. 6. This act shall be operative, and shall apply to the University of California and the California State University and Colleges, only for such times as the Legislature has appropriated funds therefor and the Regents of the University of California have accepted such funds.

SEC. 7. Any general funds made available, pursuant to provision 11 of Item 644-001-001 of the Budget Act of 1981, as amended by Chapter 169 of the Statutes of 1981, is reappropriated to the Regents of the University of California for purposes of support for the California Mathematics Project in the 1981–82 fiscal year.

SEC. 8. The level of program implementation in the 1981–82 fiscal year pursuant to this act shall be determined by Section 7 of this act and, in the 1982–83 fiscal year and each fiscal year thereafter, the level of program implementation shall be determined by such other funds as are appropriated pursuant to the annual Budget Act.

SEC. 9. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting the necessity are:

In order to implement this necessary and cost-effective program before the 1981–82 school year, it is necessary that this act take effect immediately.

APPENDIX B

California Mathematics Project Advisory Committee

Robert Preston
Manager, Technical Education
National SemiConductor

Frank Gold
Teacher of Mathematics
American Federation of Labor - Congress of Industrial Organizations

Jack Preston, *Chairman*
Mathematics and Science Department,
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Diablo Valley College
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Joseph M. Zagorski
Vice President of Instructional and Student Services,
Mt. San Antonio College
California Community Colleges

Project Administrators

Jane Stanbrough
Coordinator, Student Preparation, University of California

Linda B. Jones
Dean of New Program Development and Evaluation
The California State University

APPENDIX C

Project Summaries

Bay Area Mathematics Project

GOALS AND OBJECTIVES

The primary goal of the Bay Area Mathematics Project is to establish a network of mathematics educators, grades kindergarten through 14, which provides participants with ideas, information, personal and technical assistance, and a sense of community as they work toward the common goal of improving mathematics education in California. Achievement of this goal requires the implementation of both summer institute and academic-year project objectives.

Summer Institute Objective

> To provide mathematics educators with opportunities to share and improve their mathematics skills, instructional strategies, and techniques for attracting and retaining underrepresented groups of students, and prepare them for disseminating these strategies to their colleagues.

Academic Year Objectives

> To facilitate the continuation of the participants' leadership roles in mathematics education by helping them form a network with many teachers other than institute participants, to provide mini-grants for local projects designed by participants, to offer on-going assistance for participants' professional development, and to develop articulation within and across school programs.

PROJECT ACTIVITIES

Project staff stressed the importance of preliminary project activities, such as the establishment of a broad-based advisory committee and their planning of the summer institute, and the recruitment and selection of staff and participants to further project goal achievement. These laid the foundation for both the summer and the academic-year activities.

The summer institute served 50 participants (12 of whom were supported) from 12 Bay Area counties. A typical day's activities included announcements, introduction of visitors, comments on previous day's evaluations, an opening, whole group activity, and then smaller, grade-level group activities for the remainder of the morning. Afternoon activities included more small-group activities (some in regional groupings), presentations by resource speakers, evaluation, and closing comments. Supplemental activities included participant presentations, use of computers, and social activities. Participant presentations were only one of the techniques explored for sharing ideas: a Problem Solving Fair with learning stations and presentations provided another model.

The content theme of the institute was problem solving and it was integrated into the four weekly topics: (1) probability and statistics, (2) geometry and measurement, (3) functions and relations, and numbers and operations, and (4) integrating problem solving into all of the strands. The large group activity introduced the topic and grade-appropriate strategies for teaching the concepts were explored in the smaller groups.

Project activities to be implemented during the academic year are follow-up meetings and a mini-grant program for participants. While participants' suggestions for topics and timing of the follow-up sessions were solicited, these meetings had not been scheduled at the time of the interim report on September 1, 1983. The development, implementation, and evaluation of participant mini-grant programs will also occur during the school year. The objective of this program is to provide resources to project participants so that they can implement model projects to improve the teaching and learning of K-14 mathematics by sharing information and teaching strategies with other educators.

PROJECT EVALUATION

This project's evaluation is multi-dimensional and its evaluation mechanisms designed to serve several evaluative purposes. Participants completed a pre- and post-institute survey, some items of which will be readministered again six months after the institute. The survey is designed to measure the institute's effectiveness in achieving project goals. The initial survey assessed participants' views of the importance of

project-related goals, gathered baseline data on teaching strategies, and levels of professional activities. Subsequent surveys have and will review changes in participants' perceptions of the importance of goals and their willingness to implement the teaching strategies encouraged by staff. The survey will also assess changes in attitudes toward, and levels of, professional activities including in-service program participation, professional conferences and related changes and improvements both at the end of the institute and again later in the school year.

Project participants completed daily evaluations of project activities, the results of which project staff used for formative and summative evaluation purposes. Modifications in project activities reflected suggestions and concerns expressed by the participants through the open-ended question on these forms. Additional assessment of the the summer institute will be included in the follow-up sessions.

The quality of the mini-grant proposals and the effectiveness of the activities they support also provide an evaluation measurement for the institute. Further, the extent to which participants involve their colleagues, obtain administrative support, establish innovations that are incorporated into the regular curricula will provide measures of overall project success. Participants are also keeping logs of the contacts they have with colleagues to share the ideas developed in their BAMP experience. These evaluations will form part of the academic-year follow-up activities.

Central California Mathematics Project

GOALS AND OBJECTIVES

The primary goal of the Central California Mathematics Project is to improve instruction in mathematics in the secondary schools (grades seven through twelve) in the seven counties served by the Region 7 Teacher Education Computer Center (TECC).

To achieve this goal, project staff defined three major objectives:

1. To recognize the talent and reawaken the interest of experienced secondary mathematics teachers through a summer institute which would:
   a. give them additional, effective pedagogical techniques,
   b. give them greater insight into the mathematics that they are teaching in a way that would enable them to impart greater insight to their students, and
   c. build an esprit de corps among the participating secondary mathematics teachers which would give them a greater enthusiasm for the study of mathematics.
2. To apprise these teachers, and through them high school students and counselors, of the universities' expectations for preparation in mathematics for admission and for math-based disciplines.
3. To prepare these experienced teachers to provide in-service workshops for other teachers for the purpose of improving junior high school and elementary mathematics education.

PROJECT ACTIVITIES

The following section describes the project activities implemented to achieve the objectives of the project -- the summer institute and its follow-up sessions, and in-service training led by project participants.

1983 Summer Institute and Its Follow-Up Sessions

The summer institute of the Central California Mathematics Project accommodated 22 teachers of mathematics in grades seven through twelve from five of the seven participating counties. The institute's schedule of events included presentations by college faculty, visiting consultants, the project director, and all twenty-two teachers. The major focus of the institute was problem solving.

Improving the awareness of teachers, students, and counselors of college mathematics expectations was the focus of one morning presentation by the project director on "College Entrance Requirements" and "Entry Level Mathematics Examinations." Participating teachers were encouraged to communicate this information to counselors and students at their schools.

Five Saturday follow-up sessions are planned for the school year. The topics of these sessions will vary and the activities will include guest presenters and new presentations by participants, as well as short follow-up presentations on the effectiveness of techniques developed during the 1983 Summer Institute and reports of new ideas used in participants' classrooms. These follow-up sessions are also intended to continue the esprit de corps or network of support participating teachers developed during the summer institute phase of the project.

The September 1, 1983 project report summarized the institute's activities and related evaluation activities and results.

School District In-Service Programs

Eleven of the 22 participating teachers indicated a willingness to make in-service presentations. Project staff will work with Region 7 TEC Center in the 1983-84 school year to provide in-service support. Twenty-one of the participants indicated their intent to share institute information with their colleagues in their own schools.

PROJECT EVALUATION

Project staff observations and participants' evaluation questionnaires and daily journals comprise project evaluation information to date. Four types of evaluation forms were used. Each faculty member or consultant completed a form after their presentation evaluating how much participants learned from it and participants completed a similar form evaluating the presentation's content and applicability. Each participant also completed two forms at the end of the institute -- one measuring how much the participant thought he or she had learned from each presentation by faculty or consultants and the second measuring the same dimensions for the participants' presentations. Staff reviewed these evaluation results and formulated some recommendations for changes in evaluation procedures for future institutes. These recommendations appear in the project's September report.

Because of time constraints, project staff had not implemented any mechanisms to evaluate the effect of the institute on the quality of classroom instruction. However, staff plans to make such an effort a topic of discussion during the school-year, follow-up sessions.

Improvement of Mathematics Instruction Through Problem Solving Techniques

GOALS AND OBJECTIVES

The goal of this mathematics project is to improve the quality of mathematics teaching in grades 4 through 12 in San Bernardino and Riverside Counties by establishing a mathematics improvement teacher training program. The project seeks to achieve this goal through the implementation of the following three objectives:

1. To identify and train key classroom teachers, upgrading their knowledge and teaching skills in mathematical problem solving, and train them to conduct mathematics workshops in their own schools.
2. To establish exemplary classroom mathematics programs by key teachers with the support and assistance of the project staff.
3. To use these classrooms and teachers for in-service workshops for other teachers in the participating school districts.

PROJECT ACTIVITIES

The project is a three-phase program geared to achieve the project objectives. The following section briefly describes each of the phases:

Phase I

Key teachers in school districts will be selected and trained through an intensive workshop seminar on problem solving conducted by the Mathematics Department faculty at California State-San Bernardino during the Fall 1983 term. This training will include instruction in methods of conducting workshops. Training sessions will occur at three different sites to reduce travel time and expense for teachers in this geographically large service area. Primary responsibility for this phase resides with the college staff.

Phase II

Key teachers from Phase I will develop classroom demonstration programs implementing approaches to the problem-solving learned in the first phase. College staff will work continuously with the teachers during this phase to provide support services and guidance in program development and school district support. This phase should be completed by the end of March 1984. College staff, the school teachers, and district administrators have mutual responsibility for the project during this phase.

Phase III

Once teachers have their demonstration programs in place, they will open their classroom for visitation and observation by other teachers in the district and conduct in-service workshops for these teachers. College staff will continue to provide support to key teachers as they plan and conduct workshops and also assist other teachers to implement project ideas in their classrooms. Such workshops should be in operation through the Spring 1984 term. During this phase, key teachers and district administrators would assume primary responsibility for the project improving the possibility that the program will establish its permanency.

The timing and structure of this project is different than the majority of the first set of funded projects in that it has no summer institute component and is strictly a school-year project. By September 1, 1983, all project preparatory work had been done. Project solicitation had been sent to all school districts in San Bernardino and Riverside Counties and sixty participants had been selected. Classroom space had been obtained. classes scheduled, registration and instructional materials prepared, and evaluation activities were to proceed as originally proposed.

PROJECT EVALUATION

Evaluation efforts will be implemented for each phase. This section briefly summarizes these plans by phase.

Phase I

During Phase I classes, teachers' participation and satisfaction with class content and quality will be assessed. Instructors will also evaluate teachers' work in the class to identify areas

needing added support. Project staff will also assess the state of problem solving as an educational activity in participating teachers' schools at the start of the project.

Phase II

Project staff will document the establishment of demonstration workshops or classes, and assess their content and quality. Participating teachers will evaluate the quality and quantity of support they have received from project staff.

Phase III

Late in this phase, faculties at the schools of participating teachers will be surveyed to determine if they have attended demonstration classes and if they plan to use any of the ideas in their own classroom. At the end of the project, staff will reassess the state of problem-solving activities in participating schools. Evaluation results will appear in the project's final report.

GOALS AND OBJECTIVES

San Jose State University and the Teacher Education and Computer Center Region 8 have joined together to train a cadre of 25 mathematics teaching fellows in grades K through 12 who design, validate, and disseminate innovative methods for integrating computers into the curriculum, particularly in the areas of concept acquisition and problem solving. The following nine project objectives were established as the means to accomplish this primary goal.

1. To provide 25 teaching fellows with up-to-date instruction in educationally appropriate computer programming skills.
2. To extend participants' curriculum knowledge in the areas of mathematical concepts and problem-solving skills, particularly as they relate to appropriate standards of mathematical competence.
3. To investigate ways of improving the teaching and learning of mathematics, particularly as it applies to the encouragement of women and minorities.
4. To explore the use of the microcomputer as an instructional tool.
5. To develop innovative teaching units which integrate computers as instructional tools to encourage the active intellectual participation of students.
6. To pilot test, evaluate, revise, and disseminate innovative curriculum units.
7. To provide training in in-service and staff development teaching techniques for this regional cadre who will then train other teachers in their local districts.
8. To have a positive impact on the mathematics skills of at least 625 teachers in the five counties of TECC Region 8.
9. To evaluate and disseminate project units and information.

PROJECT ACTIVITIES

The project was designed to accomplish these objectives through a summer institute and a continuing academic-year seminar with supplementary support activities. The following section describes these two project phases and their contributions to the achievement of project objectives.

Summer Institute

The summer institutes' daily activities consisted of a course in the LOGO computer programming language, a seminar in mathematics education, and supervised computer laboratory time. In addition, staff members were available for daily consultations with participants on individual areas of interest or concern, and their curriculum projects. The Mathematics Education seminar explored four general topics: (1) the teaching of mathematics concepts and problem solving, (2) computers as a tool in mathematics teaching, (3) the future of mathematics education and computer science, and (4) in-service training strategies and methodologies. The LOGO class and the microcomputer lab time were intended to provide participants with sufficient understanding of the LOGO language to allow them to explore various models of computation and then, using LOGO as a tool, apply those models to the teaching of concept acquisition and problem solving.

The primary assignment during the summer institute was to begin the development of individual curriculum projects appropriate to each participant's grade level and interests. During the final week of the institute, projects were reviewed by the group as a whole. All participants are expected to continue to develop, test, and revise their units as the school year progresses.

Academic-Year Seminar and Support Activities

During the academic year, the follow-up seminar will concentrate on improving participants' understanding of LOGO, further development of the curriculum projects, and in-service training methodology. Each participant is expected to be involved in the training of at least 25 other local mathematics teachers. Therefore, seminar content and assignments will support the planning, development, and evaluation of additional faci-

litation and back-up for these training sessions to assure their effectiveness and responsiveness to local district needs.

PROJECT EVALUATION

The project's evaluation design is multi-dimensional. Descriptive baseline data were collected through a TECC/8 needs assessment, the applicant interview process, and a questionnaire mailed to participants prior to the summer institute. At the conclusion of the project, these data will be related to participants' success in the institute and in the delivery of training workshops for other teachers. This analysis will also provide useful information for future participant interview and selection criteria.

At the beginning of the summer institute, participants completed a test of mathematical problem solving and arithmetic reasoning ability, the Necessary Arithmetic Operations Test, two standardized tests measuring spatial ability, and a learning style inventory. Some of these tests will be given again at the end of the project so that changes can be evaluated.

Regular staff meetings and written assessments by each member of the staff were used for formative evaluation of the institute and will also be used during the follow-up activities. At the end of the summer institute, participants completed anonymous evaluations of the institute and its staff. Following the completion of the summer phase, project staff's interim evaluation states that objectives 1, 2, 3, 4, and 7 have been successfully completed and objective 5,6,8, and 9 are well underway.

Interim participant evaluations will be used in planning follow-up activities, as well as any future institutes. Other evaluation activities will include classroom visits during the school year to a random sample of participants, formal evaluation of the follow-up activities, and analysis of evaluation data from teachers attending participants' workshops. The follow-up phase will focus on project objectives 5, 6, 8, and 9 although the school-year seminar is also designed to reinforce and augment concepts and skills associated with all project goals. Summative evaluation results will be discussed in the project's final report.

Northern California Mathematics Project

GOALS AND OBJECTIVES

The primary goal of the Northern California Mathematics Project is to improve the effectiveness of mathematics instruction in primary and secondary schools (grades four through twelve) in Teacher Education and Computer Center Region 4 and in four counties in Regions 3 and 7.

To realize this goal, the project focuses on four major objectives:

1. To recognize the talent and reawaken the interest of experienced mathematics teachers and to enable them to provide in-service workshops for other teachers.
2. To apprise students, teachers, and counselors of universities' expectations for mathematics preparation for students seeking to pursue math-based disciplines.
3. To enable students to recognize their mathematical deficiencies sufficiently early so that they can be remedied at the high school level.
4. To assist minority, low-income students, and women to prepare for university-level mathematics courses.

PROJECT ACTIVITIES

The project has three components designed to accomplish these objectives: a summer institute with follow-up meetings, in-service workshops, and a diagnostic testing program. The first two components, which are funded by the California Mathematics Project, address primarily objectives 1 and 4. The diagnostics testing and liaison programs are not supported by state funds. The following section describes these three activities in terms of their contribution to the fulfillment of project objectives.

Summer Institute and Follow-Up Sessions

The summer institute and its follow-up sessions were specifically designed to implement objectives 1 and 4. The four-week institute served 29 teachers of mathematics in grades 4 through 12 from ten of the 15 counties identified by the project as its service area. Special recruitment efforts sought to include teachers in schools serving largely minority populations.

Institute activities were designed to stimulate teacher interest and self-confidence and build a support network among participants as leaders in improving mathematics education. Activities included formal course work in probability, geometry, and problem solving in the mornings. Afternoon sessions sought to enable participants to develop useful in-service workshops. To that end, visiting consultants presented special topics in mathematics education and participants prepared and presented mini in-service presentations. Each participant worked with one of four mentors, graduates of the 1982 summer institute at Davis, to plan, preview, and review the participants' presentation and assist participants to expand their presentations into full in-service workshop.

Six follow-up sessions are scheduled for the 1983-84 school year. Only the first meeting's activities have been planned -- a workshop on problem solving and mini-presentations by participants. Future follow-up activities will be planned in response to evolving participants' needs.

Project staff reviewed the summer institute in its September 1 report and summarized its evaluation of its effectiveness and recommendations for future adjustments. A subsequent section of this summary describes these efforts.

In-Service Workshops

Much of the effort of the summer institute was directed at preparing participants to conduct in-service workshops for teachers in TEC Centers 3, 4, and 7. The project director has worked with school principals and TECC directors to acquaint them with the resources these Math Project participants represent. The project sponsored a luncheon with principals and other school administrators where they could learn about these in-service resources. By September 1983, the project had been involved in in-service programs in Placer County, Esparto, and San Francisco and another is planned for Winters.

Diagnostic Testing

The project plans to continue to use the Mathematics Diagnostic Testing Project tests to enable students to recognize their mathematics deficiencies so that they will be better prepared to pursue their chosen field. This diagnostic testing project was expanded to a total of 26 schools in the Sacramento area and a consultant went to each school's mathematics department to interpret results for students in second-year algebra. This component of the project was funded elsewhere and reported on separately.

PROJECT EVALUATION

Evaluation activities for the first two components of this project were implemented at several levels. Project staff observations, participants' evaluations, and daily journals were the primary mechanisms. The September 1 report presented evaluation results to date and staff recommendations for project improvement based on these results. The following section delineates evaluation activities by project component.

Summer Institute Evaluation Activities

Participants were encouraged to record their impressions, evaluations, and recommendations in a daily journal. These journals then served as a resource to them as they responded to a seven-item subjective evaluation of the summer institute and its effect on their knowledge and on their teaching. The September 1 report included a narrative recount of participants' responses. Both staff and participants completed evaluation forms on every participant's in-service presentation. Staff reviewed all evaluation forms and then turned them over to the presenting participant for reference when developing their full-scale, in-service programs.

While the end-of-institute evaluation represents one level of evaluation, the impact of the institute on actual classroom activities and in-service efforts are better assessed as the school year progresses. This assessment by participants will be incorporated into the activities of the follow-up meetings and the results included in the final report.

Other evidence related to project effectiveness will be gathered and reported as the project progresses. These include the number and types of applicants, attendance at follow-up meetings, and the number of in-service activities.

In-Service Workshops

The nature and duration of in-service workshops will vary. Project staff does not expect one-day presentations to affect classroom activities but rather to serve as project introductions which may lay the groundwork for longer workshops. Longer workshops will be evaluated in a manner similar to the summer institute, including follow-ups with teachers to see what they actually use in their classrooms. These evaluations results will be presented in the project's final report.

Diagnostic Testing

Evaluation of the diagnostic testing portion of the program has been handled separately by means of student and teacher questionnaires. Results are available in a separate report.

San Diego State University Mathematics Project

GOALS AND OBJECTIVES

The primary goal of the San Diego Mathematics Project is to provide for the professional development of well-qualified mathematics teachers in the secondary schools of San Diego County and the surrounding area by improving their mathematics competence, their teaching effectiveness, and their leadership capacity, especially in terms of assisting crossover teachers. The project defined four objectives necessary for the overall achievement of this goal. These four objectives are:

1. To improve participants' knowledge of mathematics, including mathematics skills, conceptual understanding, and problem-solving abilities.
2. To provide participants with greater understanding of the applications of mathematics.
3. To strengthen participants' understanding of mathematics content and curriculum in the elementary and secondary schools.
4. To help participants develop a wide range of pedagogical techniques which they can use in their classrooms and share with other teachers.

PROJECT ACTIVITIES

The San Diego Mathematics Project conducted a summer institute which served 47 secondary school teachers from the greater San Diego area. The institute had two parts--Option A supported by the California Mathematics Project funds for teachers with stronger backgrounds and Option B supported by the San Diego County Department of Education for teachers with less mathematics background. The two groups attended separate morning sessions which consisted of mathematics classes. In the afternoon, they met separately for sessions on mathematical pedagogy, including the teaching of problem solving, and together for special presentations by visiting consultants on mathematics curriculum and other related topics.

Three days of follow-up activities are scheduled for the academic year. These one-day workshops will provide participants the opportunity to share experiences and ideas for the classroom, reinforce concepts introduced during the summer courses, and evaluate the success of the project. Participants will also be encouraged to attend two professional conferences where the project staff plans to have informal meetings. The purpose of these brief meetings is to encourage participants to get together at conferences, make good use of their time there, and continue to utilize one another as supportive resources.

PROJECT EVALUATION

The project evaluation efforts focus on changes in participants' knowledge of mathematics content and pedagogy, use of recommended teaching strategies, student performance and participants' assessment of the strengths and weaknesses of the project. Measurement techniques include paper-and-pencil pre- and post-tests and questionnaires at the end of the courses and during the follow-up sessions, as well as interviews and observation data. Many of these evaluation efforts are coordinated with the activities of the UCSD Mathematics Project. A complete discussion of these evaluation results will appear in the project's final report in June 1984.

Tri-County Mathematics Project

GOALS AND OBJECTIVES

The principal goal of the Tri-County Mathematics Project is to provide elementary and secondary school mathematics teachers in San Luis Obispo, Santa Barbara, and Ventura Counties with the opportunity to improve their teaching skills and mathematics education in their region. The project formulated ten objectives necessary for the accomplishment of this goal. These objectives are:

1. To develop teachers' leadership for improving mathematics education in the tri-county region.
2. To improve teachers' knowledge of and ability to teach mathematics.
3. To clarify standards of mathematics competence in light of technological changes in society.
4. To have teachers learn about and share ideas for teaching mathematics using problem solving, microcomputers, and manipulatives.
5. To increase teachers' familiarity with microcomputers and their use in teaching students about algorithms and problem solving.
6. To assist teachers in identifying needed curricular change.
7. To foster communication and cooperation between mathematics educators from different levels and schools.
8. To develop a system of mutual support for those attempting to improve mathematics education.
9. To increase teacher awareness of and ability to respond to the need to increase participation of female and minority students in mathematics.
10. To increase teachers' abilities to respond effectively to students' negative feelings about mathematics.

PROJECT ACTIVITIES

The two major activities of this project are a summer institute and in-service training workshops. Although the objectives of these two types of activities overlap, the following section discusses each of them separately.

Summer Institute

The activities of the summer institute were organized within three major components: (1) microcomputers in mathematics education, (2) teaching strategies, and (3) issues in mathematics education. The microcomputer component included such activities as daily instruction in the computer language LOGO, a microcomputer laboratory, a guest lecturer discussing the educational uses of the computer in the mathematics curriculum and small group discussions. These activities were designed to meet objectives 2, 3, 4, 5 and 6.

The teaching strategies component established the foundation for participants' in-service training efforts. Each participant made a presentation of effective teaching strategies which may be developed into in-service workshops or into a model classroom program. Alternative strategies were also explored by guest lecturers, university faculty presentations, and small group discussions. This component's activities worked to achieve objectives 1, 2, 4, 7 and 8.

The final component, issues in mathematics education, was also the focus of visiting lecturers, faculty presentations, and small group discussions. These issues include encouragement of women, minority, and low-income students in mathematics, helping students with negative feelings toward mathematics, basic skills, standards of competence, and curricular reform in a changing society. This component's activities were designed to meet objectives 1, 3, 6, 7, 8, 9 and 10.

Two full-day, follow-up meetings in each county and two full-day meetings of all participants at UCSB are planned for the school year. The objectives of these meetings is to continue to build a support network among the teachers, to facilitate the exchange of ideas for improving mathematics education, and to evaluate the impact of the project on classroom activities.

In-Service Training

The activities of the summer institute were designed to prepare participating teachers to conduct in-service workshops in mathematics and computer education. The project director will coordinate the use of these teachers and their skills with the Tri-County Teacher Education and Computer Center director and its computer consultant. In addition, the TEC Center will award mini-grants to individual or groups of teachers to assist financially in their efforts to establish model or demonstration programs. The recipients of the mini-grants will give presentations about their activities at a conference in the spring.

PROJECT EVALUATION

Summer institute evaluation activities included pre- and post-institute questionnaires to assess the background and experience of the teachers and their expectations and evaluation of the institute. Daily staff meetings provided formative evaluation of institute activities and for their modification as appeared necessary.

For each participant presentation, all participants and staff completed presentation evaluations which were given to the presenter to assist him or her in refining the presentation. Presenters also met with a staff evaluator to discuss the strengths and weaknesses of their presentations.

Finally, participants will be interviewed during the school year about their activities and the effect of the project on their classroom activities. Participants will also keep a journal documenting their project-related activities. The results of the mini-grant program should also illustrate project contributions to the improvement of mathematics education in the tri-county region.

UCLA / CSUN Mathematics Project

GOALS AND OBJECTIVES

The UCLA/CSUN California Mathematics Project aims to improve the performance of existing mathematics teachers by training master teachers who will then serve as staff development leaders for training other mathematics teachers.

The major objectives of the project are:

1. To recognize master teachers as the solid core on which the improvement of mathematics education will rest by inviting them to a summer institute.
2. To improve both the content and pedagogical aspects of the teaching skills of these teachers.
3. To train these teachers to become staff development leaders who will subsequently train other mathematics teachers with less strong mathematics backgrounds.

PROJECT ACTIVITIES

The two major activities designed to achieve these project objectives are: (1) a five-week summer institute for teachers of mathematics from grades kindergarten through 12, and (2) academic-year follow-up activities related to the impact of the summer institute on these teachers' classroom activities and on their in-service training efforts. The following section describes these activities in greater detail and indicates their degree of completion.

Invitational Summer Institute

The summer institutes were designed to meet project goals by increasing participants' knowledge of both mathematics content and teaching strategies and by providing opportunities to practice staff development techniques. Institutes were conducted at UCLA and at California State University at Northridge for 26 and 21 teachers, respectively. The components of the two institutes were similar: content-related instruction by university faculty, guest speakers, planned presentations by participants focusing on pedagogy, and social functions intended to enhance the development of a collegial network among participants which they could use during the school year.

By September 1, 1983, the project staff completed a summer institute assessment report which summarized the activities of the institutes, described the participants. and provided preliminary evaluation results which are noted in brief in a subsequent section of this summary.

Power Mathematics Program

This program seeks to strengthen elementary and junior high school mathematics teaching by establishing staff development classes at several school sites throughout the greater Los Angeles area. Classes will be conducted by staff development leaders trained through the summer institutes. As of the first of September, one ten-week and one four-week program have been scheduled with two school districts.

PROJECT EVALUATION

The following section describes the evaluation mechanisms for each of the project's main components. The evaluation design includes an assessment of both the process and products of the two components which are interrelated.

Invitational Summer Institute

The instructional content of the sessions were evaluated through informal observation and program documentation. A participant questionnaire administered at the end of the institute documented participants' perceptions of the program's quality, the appropriateness of the subject matter and pedagogical content, and their in-service needs for the upcoming academic year, and elicited their suggestions for improvement. These evaluation activities were completed during the summer institutes and preliminary analysis included in the September 1 report. A complete review of these results will appear in the project final report in May 1984.

Evaluation efforts during the academic year will focus on the impact of the summer institute on participants' classroom activities and their staff development sessions. Two evaluative techniques -- classroom observation by qualified personnel and a participant questionnaire -- will

seek to verify the use of pedagogical techniques, theories, and practices of mathematics instruction and changes in leadership abilities. Observations will occur in October, February, and May with the questionnaire administered in May also. Results of this evaluation and its implications for future project planning will be included in the project's final report.

Power Mathematics Program

Evaluation of this component is closely tied to the effectiveness of the summer institute since participants of the institutes are the instructors for this program. The evaluation of the instructional content of the sessions will include in formal observations and program documentation. Changes in participants' competence in mathematics concepts and skills will be analyzed through a comparison of pre- with post-test results. In addition, questionnaires will ask participants about their perceptions of the program's quality, appropriateness of content, and their suggestions for improvements. Subsequently, a questionnaire will ask participants about the use of the theory and practice of mathematics instruction in their own classes, changes in their attitudes toward teaching mathematics, and in themselves as teachers. The results of these evaluation strategies will be included in the project's final report.

University of California San Diego Mathematics Project

GOALS AND OBJECTIVES

The primary goal of the joint University of California San Diego and San Diego State University California Mathematics Project is to increase the level of understanding of the pre- and in-service training requirements for teachers currently responsible for the mathematics instruction in grades seven through twelve in San Diego and Imperial Counties.

The three major objectives of the Project are:

1. To develop a detailed description of the San Diego State University summer institute and assess the effects of the institute on the participating secondary school teachers.
2. To survey teacher assignments, workloads, and professional qualifications in order to document current levels of teacher qualifications and projected personnel requirements in secondary mathematics.
3. To document achievement profiles of students in schools serviced by institute participants using the Mathematics Diagnostic Testing Project.

PROJECT ACTIVITIES

Project staff initiated a number of different activities to achieve each of these three objectives. The following section describes these activities by objective and indicates the level of completion.

Description of the Summer Institute and Its Outcomes

This project's report will describe the basis upon which the participants were selected for the summer institute through a review of the participants' application forms. Differences in the levels of participants' mathematics background were evaluated through a pre-institute survey of participants. This information formed the basis of project staff recommendations on the design of institute courses for the participants. Project staff administered final evaluations of the summer institute to participants and to the institute's faculty. This evalution is both formative and summative in nature because perceptions of in-service needs will be evaluated again in May 1984, and changes evaluated over time. Finally, project staff will endeavor to determine the effects of institute activities on actual classroom practices through participant interviews, actual classroom observation by trained personnel, and involvement in the follow-up sessions for institute participants during the academic year.

By September 1, 1983, a preliminary description of the summer institute and its participants had been completed. This report includes both an objective description of participants--their educational training, credentials, and teaching loads -- institute activities, and more subjective assessments by participants and institute faculty of participants' in-service need and how these needs have been met or changed by the institute.

A final, summative evaluation of the effects of the institute and its follow-up activities on both participants' and faculties' perceptions of in-service training needs, as well as their impact on classroom activities will be the focus of the UCSD project's final report in June 1984.

Survey of Professional Qualifications and Course Loads

On the basis of this survey in San Diego and Imperial Counties, project staff will evaluate the adequacy of the pool of competent mathematics teachers for the present and future needs of this area. This evaluation will provide a profile of the current mathematics teachers by demographic characteristics such as sex and ethnic group, their academic backgrounds, and current teacher loads. The report will discuss the retirement of qualified teachers and their replacements and will project the number of secondary teachers who must be retrained to adequately prepare them for teaching secondary mathematics.

By October 1983, three separate surveying efforts were underway: (1) a district office level survey of secondary mathematics teachers' professional backgrounds, (2) a school level survey of professional training and course loads,

and (3) a survey of local teacher education programs in secondary mathematics. A full report of their results will be included in the project's final report in May.

Profile of Student Mathematics Achievement

The Mathematics Diagnostic Testing Program's instruments will be used to develop profiles of the mathematics student achievement by various demographic factors. The students will be those of teachers who are interested in asking their students to participate in this study. Since most of the exams are given in late May and early June, most data will be gathered and the analysis design completed before May 30, 1984. Analysis and reporting of the MDTP results will be completed as soon as possible after this date. Project staff will also document how a sample of institute teachers plan to use the results of these tests in the organization of their courses.

PROJECT EVALUATION

The UCSD California Mathematics Project is substantively different from the other projects funded because it does not provide any direct services to secondary teachers. This project implemented a full-phase evaluation of the San Diego State University's project from defining the need in the area, to reviewing specific project activities, to recommending changes, and to a follow-up analysis of the impact of project activities on actual classroom activities. No individual project could have dedicated the necessary resources to implement such a thorough evaluation of its own activities. Thus, the value of this project will be determined by the usefulness of the information gathered and analyzed for the improvement of mathematics education and in-service training. Particularly powerful components could then be incorporated into the evaluation portions of all California Mathematics Projects.